State of Maine
Department of Transportation

To: Darryl Belz Date: October 21, 2010

From: Dennis Emidy, Transportation Analysis

Subject: 17592.00 Augusta – Exit 113 Triangle Area Traffic Analysis

---

This technical memorandum reports on the expected traffic impacts of various alternatives under consideration for the Route 27 / Old Belgrade / Bog Road intersections area (Triangle Area) in Augusta. These alternatives were evaluated using Synchro/SimTraffic, a widely used traffic simulation and analysis software package.

Simulation Software. Synchro/SimTraffic models all vehicles traveling through a roadway network by simulating individual vehicle traffic flow. Inputs to the model include roadway geometrics, lane use, intersection control operations, intersection turning movements, and system traffic volume. As the model runs, the location of each vehicle in the model network is tracked for each second of time. With this location and time data compiled for each vehicle, the model then computes a variety of measures of effectiveness (MOE's) for each intersection approach by lane and traffic movement. This comprehensive list of MOE's includes delay per vehicle, along with 50th percentile queues, 95th percentile queues, and maximum queue lengths by lane. The primary benefits of SimTraffic (microscopic model) are that it allows the analyst to test different alternatives, view simulated traffic flows on the computer screen and see how conditions at one intersection affect other intersections. The model results reported for each signalized intersection and unsignalized intersections are based on an average of results from five randomly seeded simulations.

Traffic Volumes

The Gorrill-Palmer Exit 112/113 Study traffic volumes were used for the traffic analysis. Based on the Gorrill Palmer Study, the weekday Midday peak hour (12:00 to 1:00 PM) and PM peak hour (4:30 to 5:30 PM) were identified as the busiest hours and thus used for the 2008 existing analysis. The 2028 future analysis also used the traffic volumes from the Exit 112/113 Gorrill-Palmer Study and also was based on a Full-Service Exit 113 interchange. The Gorrill-Palmer Study used two components to develop the 2028 future peak hour traffic volumes; growth from development within the Study Area, and background growth from outside the Study Area.

A. Base Models

The Triangle Area base model simulate Midday (MD) and PM peak-hour conditions and includes intersections and their approaches, as well as the road segments between these intersections. As shown in Figure 1, the model begins south of the Route 27 / Bog Road intersection and continues north on Route 27 past the Route 27 / Old Belgrade Road and includes the Old Belgrade Road / Bog Road intersection.

The base models represent existing lane configurations and layout. For baseline conditions, the traffic control at the Route 27/ Bog Road and Route 27/ Old Belgrade Road intersections are a stop control for the side road approach. The Old Belgrade Road / Bog Road intersection is a 4-way stop.

Figure 1 Baseline 2028 PM Peak Hour Volumes Network

As mentioned above, the analysis is the average of five runs using SimTraffic. Table 1 is a summary of the MD and PM peak hour delays for the 2008 baseline and 2028 no-build.

The first part of Table 1 describes travel in the overall traffic simulation model. The travel distance is the total of the distances traveled by all vehicles in the model. The travel time is the total of the time durations each vehicle was present in the model. The travel time includes time spent by vehicles being denied entry into the model (due to capacity constraints). Total delay is equal to the total travel time minus the travel time for the vehicle with no other vehicles or traffic control devices. Network delay is used to compare models with varying number of entering vehicles in the network due to the results of randomly seeded simulations.

Table 1 Baseline 2008 and 2028 Delay Results

Measure of Effectiveness	PM 2008 Baseline	PM 2028 No-Build	Midday 2008 Baseline	Midday 2028 No-Build
Simulation Model				
Vehicle Entered	**1492**	**2330**	**1028**	**2002**
Denied Vehicles	**0**	**128**	**0**	**112**
Travel Distance (Veh-Mi.Traveled)	**894**	**1344**	**625**	**1141**
Travel Time (Veh-Hr.Traveled)	**30.3**	**163.5**	**21**	**147**
Total Delay (Hr)	**4.4**	**123.3**	**2**	**110.8**
Avg Travel Time / Vehicle (minutes in model)	**0.2**	**3.2**	**0.1**	**3.3**
Intersections				
Rte 27 / Old Belgrade				
Delay (sec/veh)	**3.9**	**38.4**	**1.7**	**5**
V/C				
Old Belgrade / Bog				
Delay (sec/veh)	**6.4**	**244.8**	**5.1**	**277.5**
V/C				
Rte 27 / Bog Rd				
Delay (sec/veh)	**4.6**	**49.1**	**2.9**	**61.5**
V/C				
Key:	Signal	Unsignalized	Roundabout	

The second part of Table 1 is a summary of the overall intersection delay. All of the Intersections for the baseline conditions are unsignalized.

Table 2 is a summary of the 95th percentile queue length (rounded up to 25 ft,) for the same time periods as in Table 1.

Table 2 Baseline 2010 and 2030 95th Percentile Queue (Ft) Results

Rte 27 / Old Belgrade	**Baseline**		**Baseline**	
Approach Direction	2008 PM	2028 PM	2008 MD	2028 MD
Rte 27 NB Thru	n/a	n/a	n/a	n/a
Rte 27 NB Right				
Rte 27 SB Left	n/a	n/a	n/a	n/a
Rte 27 SB Thru	75	225	50	175
Old Belgrade Lt/Rt	100	**875**	50	**75**
Old Belgrade Right				
Old Belgrade / Bog Rd	**Baseline**		**Baseline**	
Approach Direction	2008 PM	2028 PM	2008 MD	2028 MD
NB Old Belgrade L-T-R	75	**1375**	50	**1400**
NB Old Belgrade Left	n/a	n/a	n/a	n/a
SB Old Belgrade L-T-R	25	50	25	100
SB Old Belgrade Left				
EB Bog Rd LTR	75	325	50	125
WB Bog Rd L-T-R	50	425	50	900
Rte 27 / Bog Rd.	**Baseline**		**Baseline**	
Approach Direction	2008 PM	2028 PM	2008 MD	2028 MD
Rte 27 NB Thru	n/a	n/a	n/a	n/a
Rte 27 NB Right	n/a	n/a	n/a	n/a
Rte 27 SB Left/Thru	25	150	25	50
Bog Rd Lt	150	**825**	75	**775**
Bog Rd Rt	n/a	n/a	n/a	n/a
Key:	Signal	Unsignalized	Roundabout	

As shown in Table 1, the overall existing PM peak hour has a longer delay than the MD peak hour. The future No-Build traffic evaluation shows the traffic impact of not improving the transportation system to meet future travel demand. For the future No-Build, over 128 vehicles were unable to enter the PM network model due to capacity constraints. As shown in Table 1, under the 2028 PM No-Build, the estimated average time for a vehicle to travel through the Triangle Area network would increase from 0.2 minutes in 2008 to 3.2 minutes in 2028 without any improvements. As shown in Table 2, the PM 95th percentile queue length for the minor approach to Route 27 from Old Belgrade Road and Bog Road is over 800 feet, and approximately 1400 feet at the Old Belgrade Road and Bog Road intersection.

B. Build Alternatives

Five different build alternatives were analyzed: Upgrade Old Belgrade, Close EB Leg on Bog Road, One-Way Bog Road, Relocated Bog Road, and Relocated Rte 27-Roundabout. The following five sections will go into more detail about the traffic impacts of these five alternatives.

1. Upgrade Old Belgrade Road Alternative

The Upgrade Old Belgrade Road alternative is very similar to existing roadway conditions but improvements were made at each existing intersection to improve future traffic conditions to reasonable levels of delay. This alternative would signalize each of the three intersections. Turn lanes would be added at the following locations:

- NB Route 27 right-turn lane at Bog Road
- Left-turn lane on Bog Road at Route 27
- SB Route 27 left-turn lane at Old Belgrade Road
- NB Old Belgrade left-turn lane at Bog Road.

Figure 2 shows the 2028 PM peak hour volumes for Upgrade Old Belgrade model.

Figure 2 Upgrade Old Belgrade Rd 2028 PM Peak Hour Volumes Network

Tables 3 and 4 summarize the 2008 and 2028 MD and PM delays and the 95th percentile queues for the Upgrade Old Belgrade Road alternative.

Table 3 Upgrade Old Belgrade Road 2008 and 2028 Delay Results

Measure of Effectiveness	PM 2008 Upgrade Old Belgrade	PM 2028 Upgrade Old Belgrade	Midday 2008 Upgrade Old Belgrade	Midday 2028 Upgrade Old Belgrade
Simulation Model				
Vehicle Entered	**1487**	**2464**	**1027**	**2073**
Travel Distance (Veh-Mi.Traveled)	**891**	**1431**	**624**	**1203**
Travel Time (Veh-Hr.Traveled)	**31.4**	**72.7**	**22.1**	**50.3**
Total Delay (Hr)	**5.7**	**29.6**	**3.1**	**11.8**
Avg Travel Time / Vehicle (minutes in model)	**0.2**	**0.7**	**0.2**	**0.3**
Intersections				
Rte 27 / Old Belgrade				
Delay (sec/veh)	**6.1**	**13**	**3.4**	**7.3**
V/C	0.59	0.77	0.37	0.55
Old Belgrade / Bog				
Delay (sec/veh)	**6.6**	**11.6**	**6.2**	**10.1**
V/C	0.32	0.66	0.15	0.4
Rte 27 / Bog Rd				
Delay (sec/veh)	**5.7**	**35.2**	**5.2**	**10.5**
V/C	0.59	0.68	0.38	0.62
Key:	Signal	Unsignalized	Roundabout	

Table 4 Upgrade Old Belgrade 2008 and 2028 95th Percentile Queue (Ft) Results

Rte 27 / Old Belgrade	Upgrade Old Belgrade Rd		Upgrade Old Belgrade Rd	
Approach Direction	2008 PM	2028 PM	2008 MD	2028 MD
Rte 27 NB Thru	125	200	75	125
Rte 27 NB Right				
Rte 27 SB Left	50	125	50	125
Rte 27 SB Thru	25	25	25	50
Old Belgrade Lt/Rt	100	250	50	75
Old Belgrade Right				
Old Belgrade / Bog Rd	**Upgrade Old Belgrade Rd**		**Upgrade Old Belgrade Rd**	
Approach Direction	2008 PM	2028 PM	2008 MD	2028 MD
NB Old Belgrade L-T-R	50	175	25	75
NB Old Belgrade Left	25	75	25	100
SB Old Belgrade L-T-R	25	75	0	75
SB Old Belgrade Left				
EB Bog Rd LTR	75	150	50	125
WB Bog Rd L-T-R	50	75	50	100
Rte 27 / Bog Rd.	**Upgrade Old Belgrade Rd**		**Upgrade Old Belgrade Rd**	
Approach Direction	2008 PM	2028 PM	2008 MD	2028 MD
Rte 27 NB Thru	75	150	75	125
Rte 27 NB Right	50	50	50	50
Rte 27 SB Left/Thru	50	100	100	175
Bog Rd Lt	75	125	75	175
Bog Rd Rt	25	25	25	25
Key:	Signal	Unsignalized	Roundabout	

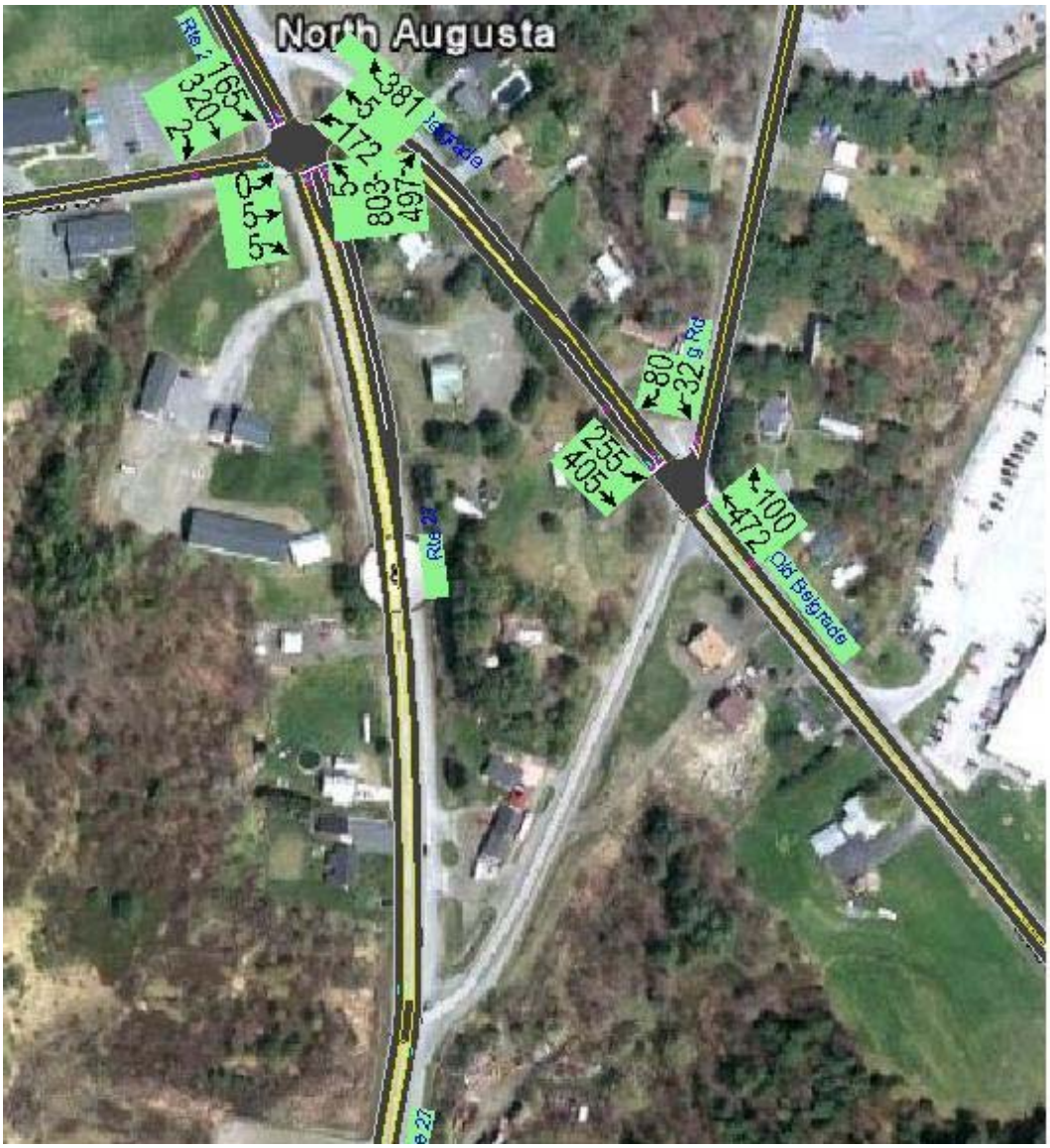
As shown in Table 3, the overall future delay for the Upgrade Old Belgrade alternative is less than for the future no-build conditions (Table 1). Adding turn lanes and signalizing all three intersections improved the transportation system to meet future travel demand. However, by signalizing all three intersections, the existing overall delays at the intersections are greater than for existing conditions.

As shown in Table 4, the future 95th percentile queue lengths are less on the minor approaches compared to the future no-build conditions (Table 2). However, the signals also introduce queuing on Route 27.

2. Close EB Leg on Bog Road Alternative

The Close EB Leg on Bog Road alternative would remove through traffic on Bog Road between Route 27 and the Old Belgrade Road intersection. Vehicles that currently use that leg of Bog Road would now need to travel to a new signalized intersection across from Wilson St (just south of the current Route 27 / Old Belgrade Road intersection). Figure 3 shows the 2028 PM peak hour volumes for Closing EB Leg on Bog Road traffic model.

Figure 3 Close EB Leg on Bog Road 2028 PM Peak Hour Volumes Network



Tables 5 and 6 summarize the 2008 and 2028 MD and PM delays and the 95th percentile queues for the Close EB Leg of Bog Road alternative.

Table 5 Close EB Leg of Bog Road 2008 and 2028 Delay Results

Measure of Effectiveness	PM 2008 Close EB Leg Bog Road	PM 2028 Close EB-Leg Bog Road	MD 2008 Close EB Leg Bog Road	MD 2028 Close EB Leg Bog Road
Simulation Model				
Vehicle Entered	**1515**	**2491**	**1032**	**2095**
Travel Distance (Veh-Mi.Traveled)	**928**	**1526**	**640**	**1302**
Travel Time (Veh-Hr.Traveled)	**31.9**	**65.1**	**22.2**	**54.1**
Total Delay (Hr)	**5.1**	**19.1**	**2.7**	**12.7**
Avg Travel Time / Vehicle (minutes in model)	**0.2**	**0.5**	**0.2**	**0.4**
Intersections				
Rte 27 / Old Belgrade				
Delay (sec/veh)	**8.4**	**21.1**	**6.6**	**16.2**
V/C	0.72	0.8	0.45	0.81
Old Belgrade / Bog				
Delay (sec/veh)	**1.9**	**5.5**	**1.4**	**5.2**
V/C	n/a	0.47	n/a	0.39
Rte 27 / Bog Rd				
Delay (sec/veh)	**n/a**	**n/a**	**n/a**	**n/a**
V/C				
Key:	Signal	Unsignalized	Roundabout	

Table 6 Close EB Leg of Bog Rd 2008 and 2028 95th Percentile Queue (Ft) Results

Rte 27 / Old Belgrade	**Close EB Leg Bog Road**		**Close EB Leg Bog Road**	
Approach Direction	2008 PM	2028 PM	2008 MD	2028 MD
Rte 27 NB Thru	200	400	100	225
Rte 27 NB Right	50	175	50	100
Rte 27 SB Left	75	275	50	175
Rte 27 SB Thru	75	125	100	200
Old Belgrade Lt/Rt	75	200	25	225
Old Belgrade Right	100	275	100	75
Old Belgrade / Bog Rd	**Close EB Leg Bog Road**		**Close EB Leg Bog Road**	
Approach Direction	2008 PM	2028 PM	2008 MD	2028 MD
NB Old Belgrade L-T-R	n/a	100	n/a	100
NB Old Belgrade Left	n/a	N/A	n/a	N/A
SB Old Belgrade L-T-R	n/a	75	n/a	100
SB Old Belgrade Left	50	150	25	75
EB Bog Rd LTR	N/A	N/A	N/A	N/A
WB Bog Rd L-T-R	50	75	50	100
Rte 27 / Bog Rd.	**Close EB Leg Bog Road**		**Close EB Leg Bog Road**	
Approach Direction	2008 PM	2028 PM	2008 MD	2028 MD
Rte 27 NB Thru	n/a	n/a	n/a	n/a
Rte 27 NB Right	n/a	n/a	n/a	n/a
Rte 27 SB Left/Thru	n/a	n/a	n/a	n/a
Bog Rd Lt	n/a	n/a	n/a	n/a
Bog Rd Rt	n/a	n/a	n/a	n/a
Key:	Signal	Unsignalized	Roundabout	

Roadway improvements for this alternative include the following:

- Relocate the terminus of Old Belgrade Road across Wilson St. to form a perpendicular approach to Route 27. Given the existing configuration (skew) of Route 27 / Old Belgrade Road, it is currently not be possible for large vehicles to make a right hand turn from Route 27 to Old Belgrade Road. Also, relocating Old Belgrade Road across from Wilson St., would eliminate signal loss time (compared to having the side streets off-set from each other) and improve traffic operations and safety in the area.
- Add turn lanes at the following locations:
  - NB Route 27 right and left- turn lanes at Old Belgrade Road
  - SB Route 27 left-turn lane at Old Belgrade Road
  - NB Old Belgrade Road right-turn lane at Route 27
  - SB Old Belgrade Road left-turn lane at Bog Road

- Install signal at the Route 27 / Old Belgrade Road intersection. Change the all-way stop at Old Belgrade/Bog intersection to stop on Bog Road only. As shown in the tables above, a signal at the Bog Road intersection would not be needed for existing conditions but would be by the future design year.
- Realign the WB Bog Road to form a perpendicular approach to Old Belgrade Road.

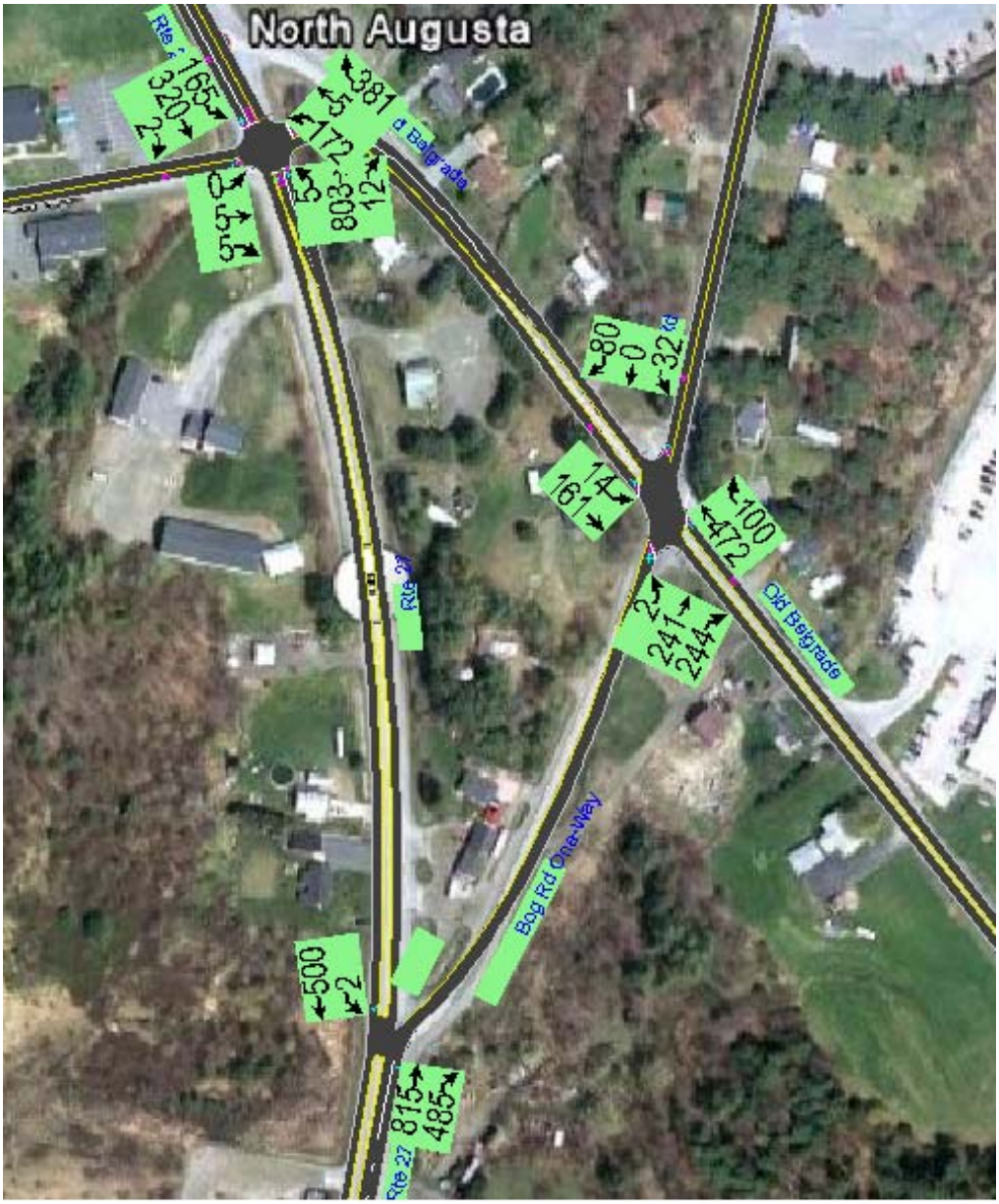
Other Traffic Considerations:

- Closing EB leg on Bog Road eliminates intersection sight distance problems caused by the skew at Bog Road / Route 27 intersection.
- Closing EB leg on Bog Road eliminates the current problem of large right-turning on Bog Road vehicles crossing over the centerline on Old Belgrade Road.
- Overall this alternative (Table 5) has an increase in vehicle-miles traveled but has less overall delay compared to No-Build (Table 1) and Up-Grade alternative (Table 3).

3. One-Way Bog Road Alternative

The One-Way Bog Road alternative would change Bog Road to a one-way from Route 27 to the Old Belgrade Road intersection. Vehicles that currently travel WB on that leg of Bog Road (between Old Belgrade Road and Route 27) would need to travel to the relocated Route 27 / Old Belgrade Road (as similarly described in Alternative 2 above). Figure 4 shows the 2028 PM peak hour volumes for the One-Way Bog Road traffic model.

Figure 4 One-Way Bog Road 2028 PM Peak Hour Volumes Network



Tables 7 and 8 summarize the 2008 and 2028 AM and PM delays and the 95th percentile queues for the One-Way Bog Road alternative.

Table 7 One-Way Bog Road 2008 and 2028 Delay Results

Measure of Effectiveness	PM 2008 One-Way Bog Road	PM 2028 One-Way Bog Road	MD 2008 One-Way Bog Road	MD 2028 One-Way Bog Road
Simulation Model				
Vehicle Entered	**1478**	**2529**	**1001**	**2107**
Travel Distance (Veh-Mi.Traveled)	**861**	**1451**	**595**	**1240**
Travel Time (Veh-Hr.Traveled)	**29.8**	**64.4**	**20.7**	**53.5**
Total Delay (Hr)	**4.7**	**21.4**	**2.4**	**13.6**
Avg Travel Time / Vehicle (minutes in model)	**0.2**	**0.5**	**0.1**	**0.4**
Intersections				
Rte 27 / Old Belgrade				
Delay (sec/veh)	**8.5**	**24.4**	**6.6**	**18.9**
V/C	0.68	0.81	0.45	0.82
Old Belgrade / Bog				
Delay (sec/veh)	**3.8**	**14.8**	**2.3**	**8.2**
V/C		0.7		0.46
Rte 27 / Bog Rd				
Delay (sec/veh)	**n/a**	**n/a**	**n/a**	**n/a**
V/C				
Key:	Signal	Unsignalized	Roundabout	

Table 8 One-Way Bog Rd 2008 and 2028 95th Percentile Queue (Ft) Results

Rte 27 / Old Belgrade	One-Way Bog Road		One-Way Bog Road	
Approach Direction	2008 PM	2028 PM	2008 MD	2028 MD
Rte 27 NB Thru	150	600	100	250
Rte 27 NB Right				
Rte 27 SB Left	75	175	50	200
Rte 27 SB Thru	75	125	100	200
Old Belgrade Lt/Rt	75	175	100	250
Old Belgrade Right	100	250	50	100
Old Belgrade / Bog Rd	**One-Way Bog Road**		**One-Way Bog Road**	
Approach Direction	2008 PM	2028 PM	2008 MD	2028 MD
NB Old Belgrade L-T-R	n/a	200	n/a	125
NB Old Belgrade Left	n/a	N/A	n/a	N/A
SB Old Belgrade L-T-R	n/a	100	n/a	75
SB Old Belgrade Left	0		0	
EB Bog Rd LTR	75	300	50	150
WB Bog Rd L-T-R	50	75	50	125
Rte 27 / Bog Rd.	**One-Way Bog Road**		**One-Way Bog Road**	
Approach Direction	2008 PM	2028 PM	2008 MD	2028 MD
Rte 27 NB Thru	n/a	n/a	n/a	n/a
Rte 27 NB Right	n/a	n/a	n/a	n/a
Rte 27 SB Left/Thru	0	0	0	0
Bog Rd Lt	N/A	N/A	n/a	N/A
Bog Rd Rt	N/A	N/A	n/a	N/A
Key:	Signal	Unsignalized	Roundabout	

Roadway improvements for this alternative include the following:

- Relocate the terminus of Old Belgrade Road across Wilson St. to form a perpendicular approach to Route 27. Also, relocating Old Belgrade Road across from Wilson St., would eliminate signal loss time (compared to having the side streets off-set from each other) and improve traffic operations and safety in the area.
- Add turn lanes at the following locations:
  - NB Route 27 left-turn lane at Old Belgrade Road
  - SB Route 27 left-turn lane at Old Belgrade Road
  - NB Old Belgrade Road right-turn lane at Route 27
  - NB Route 27 right-turn lane at Bog Road.
- Install signal at the Route 27 / Old Belgrade Road intersection. Change the all-way stop at Old Belgrade/Bog intersection to stop only on Bog Road

approaches. As shown in the tables above, a signal at the Bog Road intersection would not be needed for existing conditions but would be by the future design year.

- Realign the WB Bog Road to form a perpendicular approach to Old Belgrade Road.

Other Traffic Considerations:

- The One-Way on Bog Road eliminates intersection sight distance problems caused by the skew at Bog Road / Route 27 intersection.
- The One-Way reduces the impacts at the Old Belgrade intersection because large right turning vehicles will be able to utilize the existing pavement width to accomplish the turn movement.
- Overall this alternative (Table 7) has the least vehicle-miles traveled and vehicle-hours traveled compared to the other alternatives.

4. Relocate Old Belgrade Road Alternative

The Relocate Old Belgrade Road alternative would avoid the Triangle area by creating a new alignment and relocating Old Belgrade Road from approximately 700 feet south of the Bog Rd / Old Belgrade Road intersection to Route 27 (near the existing Bog Road). This alternative would remove through traffic on the southbound and eastbound approaches to the Old Belgrade / Bog Road intersection. Southbound Route 27 vehicles that currently turn left at Old Belgrade Road would now turn left at the new Route 27 intersection. Vehicles that currently turn right onto Bog Road would now turn right on the relocated Old Belgrade Road and then turn left at a new intersection (Old Belgrade Road and Relocated Old Belgrade Road) to continue onto Bog Road.

Figure 5 Relocate Old Belgrade Road 2028 PM Peak Hour Volumes Network

Tables 9 and 10 summarize the 2008 and 2028 MD and PM delays and the 95th percentile queues for the Relocate Old Belgrade Road alternative.

Table 9 Relocate Old Belgrade Road 2008 and 2028 Delay Results

Measure of Effectiveness	PM 2008 Relocate Old Belgrade	PM Future Relocate Old Belgrade	Midday 2008 Relocate Old Belgrade	Midday 2008 Relocate Old Belgrade
Simulation Model				
Vehicle Entered	**1507**	**2474**	**1041**	**2123**
Travel Distance (Veh-Mi.Traveled)	**927**	**1483**	**629**	**1245**
Travel Time (Veh-Hr.Traveled)	**32**	**74.8**	**22**	**52.2**
Total Delay (Hr)	**4.9**	**30**	**2.6**	**12.1**
Avg Travel Time / Vehicle (minutes in model)	**0.2**	**0.7**	**0.1**	**0.3**
Intersections				
Rte 27 / Old Belgrade				
Delay (sec/veh)	n/a	n/a	n/a	n/a
V/C				
Old Belgrade / Bog				
Delay (sec/veh)	**0.7**	**1.1**	**0.5**	**0.7**
V/C				
Rte 27 / Bog Rd				
Delay (sec/veh)	**8.5**	**40**	**6.5**	**16.1**
V/C	0.71	0.84	0.48	0.75
Old Belgrade / New Connection				
Delay (sec/veh)	**2**	**3.8**	**1.5**	**3.6**
Key:	Signal	Unsignalized	Roundabout	

Table 10 One-Way Bog Rd 2008 and 2028 95th Percentile Queue (Ft) Results

Rte 27 / Old Belgrade	**Relocate Old Belgrade Rd**		**Relocate Old Belgrade Rd**	
Approach Direction	2008 PM	2028 PM	2008 MD	2028 MD
Rte 27 NB Thru	n/a	n/a	n/a	n/a
Rte 27 NB Right				
Rte 27 SB Left	n/a	n/a	n/a	n/a
Rte 27 SB Thru	n/a	n/a	n/a	n/a
Old Belgrade Lt/Rt	n/a	n/a	n/a	n/a
Old Belgrade Right				
Old Belgrade / Bog Rd	**Relocate Old Belgrade Rd**		**Relocate Old Belgrade Rd**	
Approach Direction	2008 PM	2028 PM	20008 MD	2028 MD
NB Old Belgrade L-T-R	0	0	0	0
NB Old Belgrade Left	n/a	n/a	n/a	n/a
SB Old Belgrade L-T-R	0	0	0	0
SB Old Belgrade Left				
EB Bog Rd LTR	n/a	n/a	n/a	n/a
WB Bog Rd L-T-R	0	0	0	0
Rte 27 / Bog Rd.	**Relocate Old Belgrade Rd**		**Relocate Old Belgrade Rd**	
Approach Direction	2008 PM	2028 PM	2008 MD	2028 MD
Rte 27 NB Thru	125	375	100	225
Rte 27 NB Right	50	175	50	100
Rte 27 SB Left/Thru	75	175	100	200
Bog Rd Lt	75	175	75	225
Bog Rd Rt	100	250	50	75
Relocate Old Belgrade / Relocated Bog Rd	**Relocate Old Belgrade Rd**		**Relocate Old Belgrade Rd**	
Approach Direction	2008 PM	2028 PM	2008 MD	2028 MD
Reloc Bog Rd SB Lt	25	50	25	75
Reloc Bog Rd SB Rt	25	50	25	75
Reloc Old Belgrade WB Rt	0	25	0	0
Reloc Old Belgrade EB Lt	50	100	25	75
Key:	Signal	Unsignalized	Roundabout	

Roadway improvements for this alternative include the following:

- Close the existing Route 27 / Old Belgrade Road intersection (north of Wilson St.) to through traffic.
- Construct new roadway from Old Belgrade Road to Route 27.
- Add turn lanes at the following locations:
  - NB Route 27 right-turn lane at relocated Old Belgrade Road
  - SB Route 27 left-turn lane at relocated Old Belgrade Road
  - WB relocated Old Belgrade Road left and right-turn lanes at Route 27
  - EB relocated Old Belgrade Road left-turn lane at new intersection.
  - WB relocated Old Belgrade Road right-turn lane at new intersection.
  - SB Old Belgrade Road left and right turn lanes at new intersection.
- Install signal at the Route 27 / relocated Old Belgrade Road intersection.

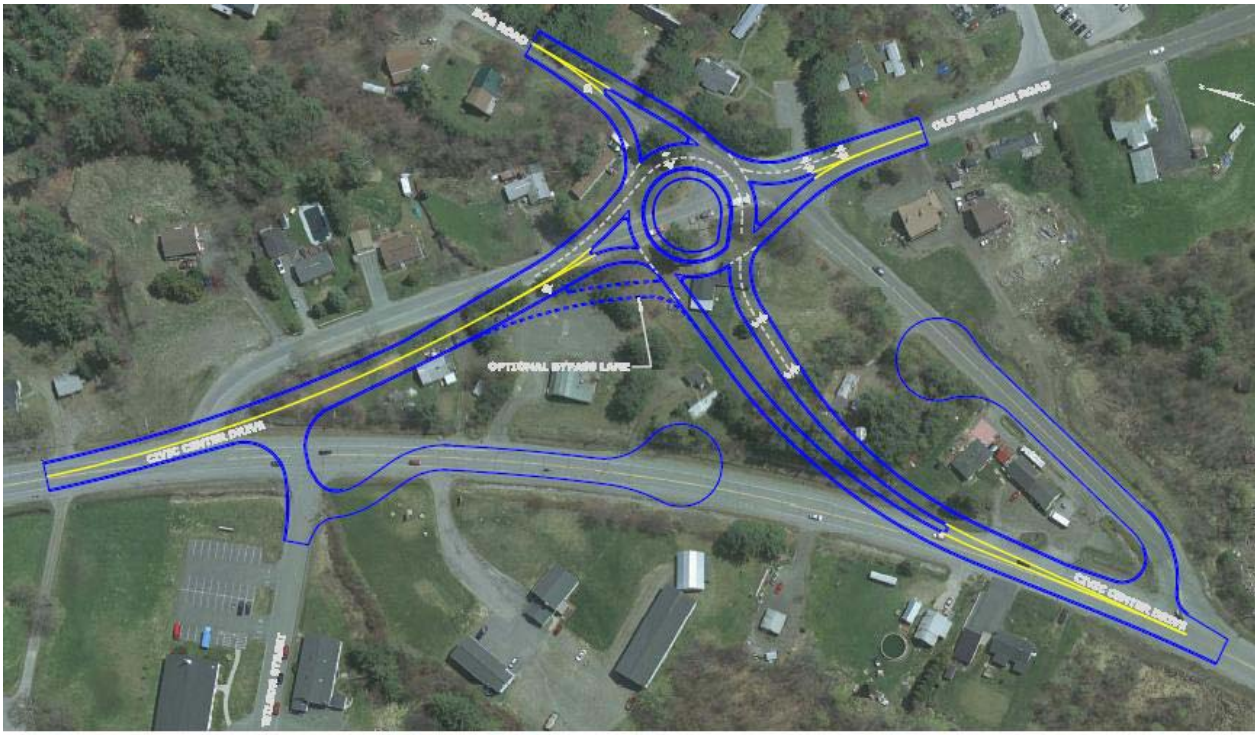
Other Traffic Considerations:

- There would be a steep grade on the Relocated Old Belgrade Road from Route 27 to Old Belgrade Road. If there were to be a future signal at the new intersection it could create problems due to the grade.
- This alternative would remove through traffic in the Triangle area and bring all interstate and Old Belgrade Road traffic into one intersection.
- Overall this alternative (Table 9) has the longest delays compared to the other alternatives and is second only to the Close EB Leg of Bog Road alternative in the most vehicle-miles traveled.

5. Relocate Route 27-Roundabout Alternative

The Relocate Route 27 Roundabout alternative would construct a roundabout in the vicinity of the Old Belgrade and Bog Road intersection in which all Route 27 traffic would enter through the roundabout and the existing section of Route 27 between Bog Road and Old Belgrade Road would become a local road for the existing businesses and residence on that section of roadway. Figure 6 is a concept plan of the Relocated Route 27 – Roundabout alternative.

Figure 6 Relocate Route 27-Roundabout Alternative



The number of lanes required for the roundabout is based on Rodel software. The Rodel software is specifically designed for roundabouts. Although not ideal for roundabout analysis, Table 11 summarizes the SimTraffic results so that a comparison could be done to the other alternatives. As shown in Table 11, the SimTraffic results had slightly less delay compared to the Rodel results.

Table 11 Relocate Route 27- Roundabout Road 2008 and 2028 Delay Results

Measure of Effectiveness	PM 2008 Roundabout Relocate Rte 27	PM 2028 Roundabout Relocate Rte 27	MD 2008 Roundabout Relocate Rte 27	MD2028 Roundabout Relocate Rte 27
Simulation Model				
Vehicle Entered	**1478**	**2495**	**992**	**2083**
Travel Distance (Veh-Mi.Traveled)	**911**	**1477**	**612**	**1224**
Travel Time (Veh-Hr.Traveled)	**38.9**	**68.1**	**25.9**	**58.5**
Total Delay (Hr)	**2.5**	**9.4**	**1.3**	**9.6**
Avg Travel Time / Vehicle (minutes in model)	**0.1**	**0.2**	**0.1**	**0.3**
Intersections				
Rte 27 / Old Belgrade				
Delay (sec/veh)	**n/a**	**n/a**	**n/a**	**n/a**
V/C				
Old Belgrade / Bog				
Delay (sec/veh)	**3.5**	**8.7**	**2.8**	**12.5**
V/C		**(9.3 Rodel)**		**(14.1 Rodel)**
Rte 27 / Bog Rd				
Delay (sec/veh)	**n/a**	**n/a**	**n/a**	**n/a**
V/C				
Key:	Signal	Unsignalized	Roundabout	

Roadway improvements for this alternative include the following:

- Construct new roadway for the diverted Route 27 portion to the roundabout.
- Construct a two-lane roundabout approach for NB Route 27and NB Old Belgrade Road.
- Construct a slip-lane for SB Route 27 vehicles.

Other Traffic Considerations:

- This alternative would not require a signal.
- This alternative would require all Route 27 vehicles to be diverted.
- Concern for safety of vehicles turning left from Old Belgrade Road to Wilson St / local businesses and residences.
- This alternative has vehicles-miles traveled and vehicle-hours traveled than the One-Way Bog Road alternative. However,this alternative but has the least total delay.